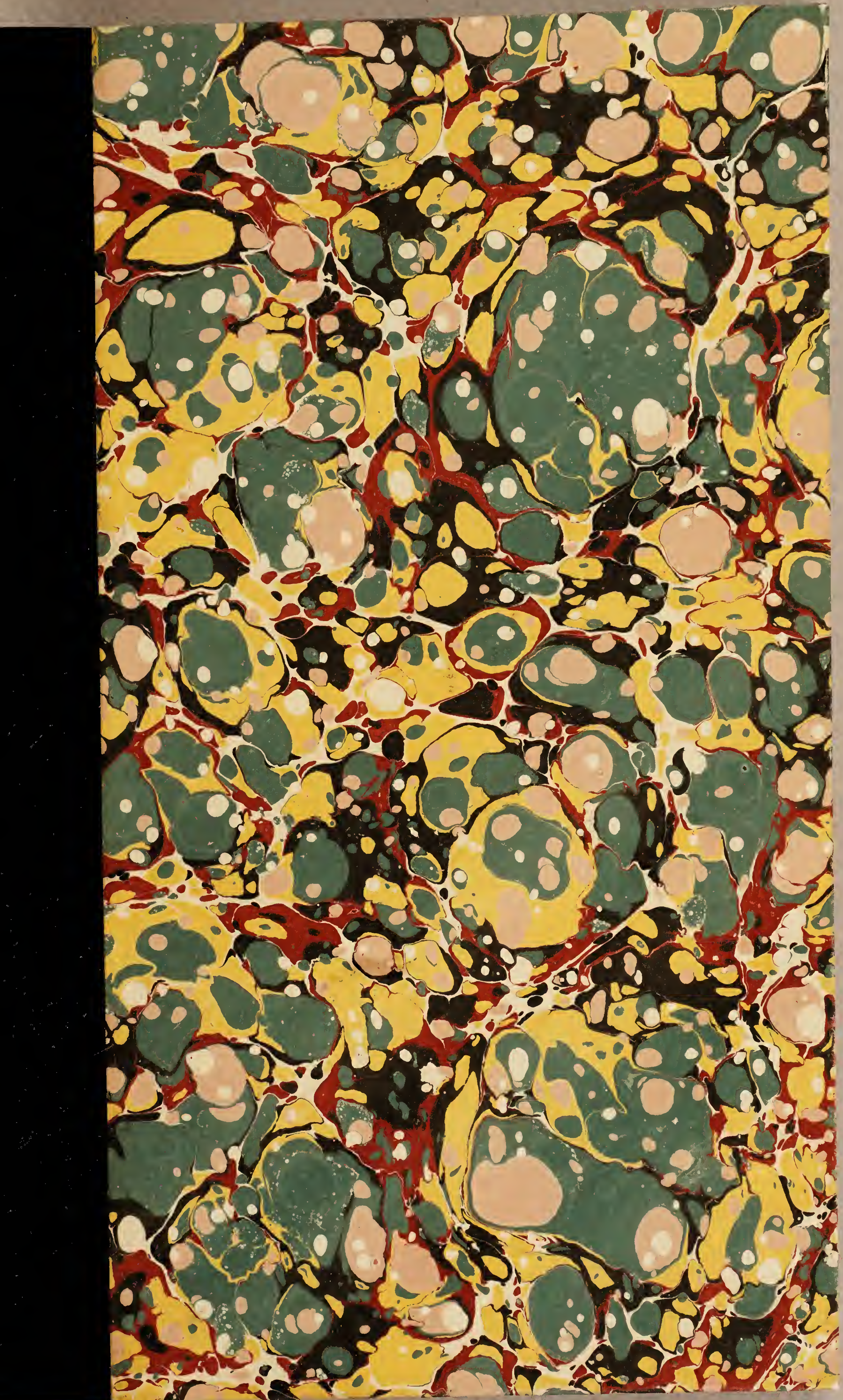

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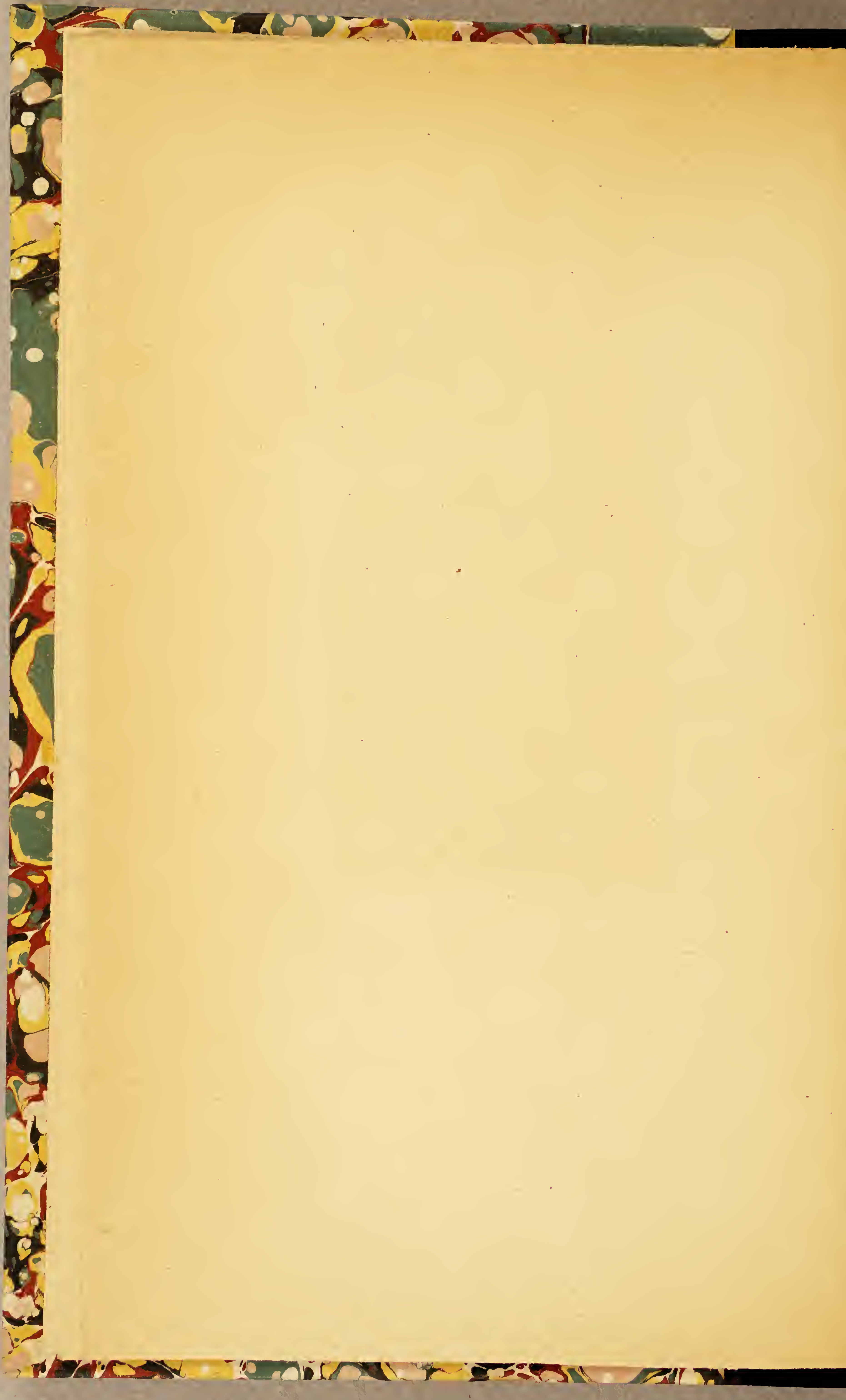

ter Sir James Douglas

AN ESSAY

Towards a

METHOD

Of Preſerving the

SEEDS of PLANTS

In a State fit for Vegetation, during
Long Voyages.

For the Improvement of the

BRITISH COLONIES in AMERICA.

By the Rev. Mr. PULLEIN.

LONDON:
Sold by A. Millar in the Strand; and T. Pote in
Fleet-ſtreet. 1759.

RPJCB

TO THE

RIGHT HONOURABLE

The Earl of BUTE.

My Lord,

I Am encouraged by former favours, and by your Lordſhip's knowledge of Vegetable Nature, to put the following eſſay under your Lordſhip's protection. If it ſhall be found to contain any thing which may be of publick ſervice, your Lordſhip's reputation cannot fail of advancing this intention of

Your Lordſhip's
very obliged, and
humble Servant,

SAMUEL PULLEIN.

October 27,
1759.

AN ESSAY

On Preserving the SEEDS of PLANTS, &c.

IT has been the opinion of moſt Botanical writers, that the ſeeds of Plants could not be preſerv'd in a State fit for vegetation, if the admiſſion of freſh air was totally hindered: and on this principle, they have adviſed that ſeeds ſhould not be cork'd up in bottles, or in any other way cloſely confin'd; and to ſtrengthen this opinion, they have mention'd, if I remember right, the bad ſucceſs which they have had in raiſing ſeeds which were kept in this manner.

I will not diſpute this fact; but yet I am of opinion, that the reaſon why ſuch ſeeds did not vegetate, was not becauſe freſh air was excluded, but becauſe they were confin'd in an air, which, by being pent up and loaded with the matter perſpiring from the ſeeds, became continually more unwholeſome, ſo as at laſt to deſtroy the vegetative principle.

But, whatever were the cauſe, that ſeeds thus kept did not grow, I will venture to propoſe an opinion very different from that which had been generally receiv'd, by all whom I ever talk'd to, or read on this ſubject: and this is, that the moſt likely ly method to preſerve the vegetative principle of ſeeds, for any long ſpace of time, is totally to exclude the air; and on this principle I ſhall offer ſuch methods, as I judge will be found moſt effectual and moſt practicable. I ſhall indeed only offer them as eſſays for tryals, becauſe tho' I have long ſince made ſome experiments which ſtrengthen my opinion, and tho' the theory on which I founded them ſeems to me very reaſonable, yet, as judicious experiments muſt always eſtabliſh or overthrow any theory, ſo muſt many and repeated tryals be always of greater weight than a few.

It is about ſeven or eight years ago that I intended raiſing ſome Mulberry trees from ſome ſeed which I had collected, and not having at that time a conveniency of ground, I was deſirous of preſerving the ſeed to a convenient time, becauſe in the ſituation I then was, I could not eaſily procure more.

The following conſiderations then occurred to me, firſt, that ſeeds waſted and loſt their vegetating ſtrength by continual perſpiration, which leſſen'd that nutritious part on which the young germ was to be nouriſhed; ſecondly, that the external air, beſides being a great promoter of this perſpiration, acted alſo as an inſtrument of vegetation, and by frequently putting this principle in motion, and not being aided by ſufficient moiſture to compleat the work, did often totally deſtroy the vegetable life of the germ. The many curious experiments which Romeur had made on the preſerving of eggs in a ſtate fit for incubation, and the obſervations which have been made on thoſe eggs where the punctum ſaliens had been put in motion, and afterwards ſtopt by cold, did at the ſame time occur, and (by transferring

ferring the analogy from animals to vegetables) ſtrengthen my opinion. The conſideration alſo of ſeeds, which were ſuppos'd to lie many years in an unvegetating ſtate at great depth in the earth, had ſome weight, tho' this might indeed poſſibly be from want of heat and moiſture as well as of air.

Upon this conjectural theory I then made the following experiment: I collected a conſiderable quantity of ripe Mulberries, and putting them into a coarſe cloth, preſſed out as much of the juice as I could, ſo that the pulp with the ſeeds in it remained in the conſiſtence of a paſte; I took this and formed it into the ſhape of a round flat cake about three quarters of an inch thick, and ſix inches diameter, ſmoothing it ſo with my hand that there was no crack nor roughneſs in it; I then laid it upon a piece of paper, and placing it upon a board put it in the ſun to dry, now and then turning its under ſide uppermoſt. When it was grown of ſufficient hardneſs to ſtand on its edge, I brought it into the houſe, and placing it on a ſhelf, in that ſituation, I ſuffered it to attain its utmoſt dryneſs and hardneſs in the ſhade, after which I wrapped it ſlightly in ſome paper and laid it up. While I was drying it I was forced to ſecure it from mice, which are very greedy of the ſweet kernel which the ſeed contains, and once or twice eat a good deal of it.

On the enſuing ſpring I ſowed a ſmall quantity of the ſeed, ſoftening a piece of the cake in water, and then mixing it with ſand to divide and ſeparate the ſeed. This in about ſix weeks ſprung and produced plants. The remaining part of the cake I ſmeared over with a feather dipped in melted tallow, ſo as to leave no part uncovered, and laid it up for further tryals: I ſowed ſome of this after four years, and it ſprung and produced good plants; and I have yet ſome of it which is above ſeven years old, which I make no doubt will grow, becauſe upon examining the ſmall kernels contain'd in the ſeed they were plump and fair.

The reaſons why I did not ſmear the cake with tallow as ſoon as it was dry, was becauſe I judged it neceſſary that the ſeed ſhould be free from all ſuperfluous moiſture, and the kernel attain a certain degreee of firmneſs, before its perſpiration was totally ſtopped by the tallow; and I knew that it retained its vegetative power when I ſtopped it. Indeed I have tried and found, that the ſeed will grow after two years (beyond which I have not tryed it) by barely preſerving it in ſuch a cake as I have deſcribed, without ſmearing it with tallow; for the pulp of the berry does a good deal ſtop perſpiration, and hinder the kernel from waſting itſelf.

From the time of making the above mentioned tryals, I thought no further on this ſubject till about a year ago, at which time, there being a deſign of introducing ſome of the Eaſt-India plants into America, I was aſked my opinion concerning ſome effectual method of preſerving them, and I then gave the above thoughts and experiments as pointing a very probable means of ſucceſs: but that further trials may be made by thoſe who have better opportunities than I, I ſhall here give what occurs to me as neceſſary or uſeful in this method of preſerving ſeed; which, tho' it ſhould reflect only a faint light, may poſſibly help to diſcover ſomething uſeful in this enquiry.

Firſt then, it appears to me to be neceſſary that the matter uſed to preſerve ſeed ſhould be of the nature either of tallow, roſin, or bees wax; for tho' it may be thought that mucilaginous gums might ſerve, yet it is to be conſidered that they both admit moiſture and throw it off into the air, and therefore if we ſuppoſe (for inſtance) a hazel nut coated with ſuch gum, then as faſt as the juices of the kernel pervade the ſhell, they will be imbibed by the gum, and being further drawn to its ſurface will be taken up by the air, ſo that ſuch kind of gum will have little efficacy in preſerving the nutricious juice of ſeeds from waſting for any long time; whereas if we ſuppoſe the ſame nut coated with tallow, wax or roſin, then as faſt as the juice pervades the ſhell, it will be arreſted by the tallow, &c. which it cannot pervade, and according to the heat or cold, and the perſpiring or imbibing ſtate of the kernel, it will be thrown on the reſin, or reſorb'd from it by the nut.

It ſeems in the next place neceſſary, that the preſerving matter ſhould have a certain degree of conſiſtence, ſo as not to be melted by the greateſt heat of the weather; and yet it ſhould melt with ſuch a degree of heat as ſhall not injure the ſeed while it is uſed in coating it.

From ſome experiments which I have made, uſing Farenheit's thermometer, I find the following ſubſtances melt, and continue fluid nearly at the degrees here ſet down; I ſay nearly, becauſe it is no eaſy matter to fix the preciſe point in bodies that have a tenacious fluidity.

Butter melted about, deg. 86, continued fluid to 75.
Tallow melted at———110, continued fluid to 97.
Bees-wax melted at———148, continued fluid to 142.
* Sulphur melted at———222, continued fluid to 214.

Reſin is very undetermined in the degree that melts it to fluidity, which fluidity it immediately loſes and becomes tenacious. That kind which I tried grew fluid at 180.

From an inſpection of theſe heats it appears, that butter melting with too low a degree of heat, is capable of being diſſolved by the weather, and therefore an improper material: and that reſin and ſulphur loſing their fluidity at high degrees are too hot, and would endanger the ſeeds; but tallow or bees-wax, on account of the more moderate heat in which they continue fluid, and becauſe they require a degree greater than the ordinary warmth of air in any climate to melt them, may be proper materials to coat ſeeds, in order to hinder perſpiration, and to exclude the action of the air.

Now as different ſeeds, according to their ſize, form, &c. will require a different method of coating, I ſhall here by way of ſpecimen apply a method to the hazel-nut, which, with ſome ſmall occaſional variations, may ſerve for the larger kinds of ſeed.

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* Sulphur has a peculiar quality which I don't know that any chymical writer has mention'd, viz. with a degree of heat about 222, it is as tenacious as thick melted glue. but with a leſs degree about 214, juſt before it is become ſolid, it is as fluid as water.

Firſt, heat ſome water in a ſmall tin pannicle to ſuch a degree as will juſt keep tallow or bees-wax fluid; let it be near full of water, ſo that it may contain only about a quarter or half an inch thickneſs of melted wax on its ſurface; ſet beſide it a ſmall veſſel of cold water, and now to perform the coating you muſt have a ſmall pair of plyers with ſharp points turned inward (they may be eaſily made of a piece of ſtrong tin cut and bended into that form) then take a hazel-nut and fix it between the two points of the plyers, with its ſmall or germinating end uppermoſt, and when the wax is melted on the ſurface of the water, immerge the nut in it with a ſudden dip, and then as quickly as you can dip it in the veſſel of cold water, thus it will be coated over with wax without much danger of being hurt by the heat, which will not have time to penetrate the ſhell, and the germinating end being uppermoſt will be the ſhorteſt time in the heat.

Moſt large ſeeds may be coated in this manner, and even the ſmaller ſeeds, which are contain'd in dry coriaceous pods, may have the whole pod covered in the ſame way, which I imagine will be ſufficient to preſerve them for as long a time as is neceſſary; but it ſhould be remembered to let them always have attained a proper degree of hardneſs and dryneſs before they are coated, for if it is done while they are too moiſt, I conjecture that the too great quantity of moiſture which it confin'd, might be of diſſervice. If melted bees-wax is found by experience to be any way hurtful by too great heat, then melted tallow may be uſed in its ſtead, to which I know no objection, but that it might poſ-

ſibly

ſibly melt in ſome very hot climates if not kept in a cool place. But as melted tallow juſt ſtiffens at 97, or with the blood heat, and is not melted till the heat is rais'd to 110, I think it the beſt material, at leaſt for ſmall and tender ſeed, and it may be made to bear a greater heat without running, by ſprinkling powder'd chalk over the ſeed while it is yet fluid on them; and ſo may other mixtures of oil and tallow which would otherwiſe run with lower degrees of heat.

The very ſmall ſeeds, which have thin and tender coats, may be preſerved by kneading up a quantity of them into ſmall pellets with clay, and when the pellets are compleatly dry, coating each of them in the ſame manner as you did the hazel-nut; or if they are ſeeds whoſe berries are pulpy, they may be managed as I mentioned in the caſe of the mulberries, firſt forming them into ſmall cakes or pellets, and then coating them with bees-wax or tallow.

If it ſhould be found expedient, to coat any particular kind of ſeed, with a material which keeps fluid at any of the intermediate degrees between 97, which is that which keeps tallow fluid, and 142, which is that of bees-wax, then a mixture of bees-wax and tallow in various proportions, will produce ſuch materials: thus upon trial, I find, that equal weights of tallow and bees-wax compoſe a ſubſtance which melts about deg. 140, and continues fluid to about 130; and thus, by ſtill mixing a greater proportion of tallow with the bees-wax, the degree of heat neceſſary to keep the mixture fluid, will ſtill grow lower, till at laſt it arrives to 97, the loweſt heat in which tallow continues fluid.

Tallow mix'd in different proportions with any of the more fluid and leaſt tenacious oils, will conſtitute mixtures, which will ſtill keep fluid, with lower degrees of heat even down to 43, the degree at which oil olive loſes its fluidity. I mention this not as properly pertinent to the preſent ſubject, (where a degree of heat, much below that of melted tallow, cannot conveniently be uſed in the hotter climates) but becauſe I think, on this principle, there may be conſtructed very convenient and cheap thermometers for common uſe in hot-houſes, which ſhall only conſiſt of ſmall glaſs vials, containing different proportions of tallow, and ſuch oil as I have mentioned; for when the degrees of heat, at which the different mixtures continue ſolid or fluid, tranſparent or opaque, are fix'd by experiment, then each vial may be made a diſtinct thermometer, which will regulate the degree of heat that is known to be moſt agreeable to different plants in every different part of the hot-houſe. But to return to the ſubject of this eſſay, tho' plants may have their vegetative principle preſerved in the manner which I have deſcribed, yet there is one thing ſtill to be obſerv'd, and this is, that in any caſe where the ſeed itſelf is ſmear'd with tallow or wax, it is neceſſary before it is ſown to clear it away; for Romeur obſerves, that eggs which were varniſhed over, would not produce chickens, unleſs the varniſh was ſcraped off, nor even then, till new pores were opened by ſuch ſcraping, to ſupply the place of thoſe which had been filled by the varniſh; and, by a parity of reaſon, it ſeems neceſſary, to free the ſeeds of plants from every thing that might ſtop their pores: and to do this, no more is neceſſary than to ſcrape the larger ſeed with a knife, and the ſmaller kind may be rubbed in a bag with ſoap-water and a little fine ſand in ſuch a degree as their texture will bear, till the wax or tallow is cleared away, and free acceſs given to air and moiſture, which, with the addition of heat, are the great inſtruments of vegetation: and here there occurs to my memory, a method propoſed lately by Linnæus, for preſerving ſeeds in a vegetating ſtate, by keeping them very cool by the means of ſome particular kinds of ſalt. Could he indeed have kept them cool by this method, the thing had been effected, but he ſeemed to me to proceed intirely upon theory, without experience; for ſalts do not produce cold but in the act of ſolution; and I have not found, that any dry ſalt, which has ſtood ſo long in the air as to acquire its temperature of heat, will in the leaſt degree ſink the thermometer which ſtands in the ſame air. This made me ſuſpect Linnæus's method when it was firſt mentioned; and what I have ſince try'd on ſalts, ſtrengthens my ſuſpicion. And here let me mention, that though artificial fires will indeed heat air in the coldeſt climates; yet, to cool ſufficient quantities of air for reſpiration in hot climates, there ſeems but one method probable, which is to make the air deſcend ſlopingly in pipes or channels, cut thro' the bodies of hills, and thus convey it into houſes ſituated on the ſides, or at the foot of ſuch hills. Air by ſuch a paſſage, might acquire a more temperate degree; and as it became cooler, would, I believe, ſufficiently deſcend by its own weight, or might at leaſt be drawn through in ſufficient quantities by a ventilator; a thing, which, could it be eaſily perform'd, would be a moſt comfortable circumſtance in many of our hotter colonies of America.

If what I have delivered on the ſubject with which I ſet out, ſhould anſwer my expectation, and produce an eaſy and effectual method of preſerving ſeed in a vegetative ſtate for a length of time, ſufficient to tranſport them from the Eaſt-Indies, to any part of America, then, as we have poſſeſſions there, which take in all the different climates of the Eaſt, it is very probable, that many of its productions may be rais'd in our own colonies or iſlands; ſuch as teas, ſpices, and many other valuable commodities; nor do I ſuppoſe, that thoſe ſkilled in theſe matters, will think that the raiſing ſuch commodities in the colonies would hurt the revenues of the crown, but rather be an advantage, as duties might be rais'd higher in proportion, as the diſtance, and conſequently the expence of importation, leſſened.

Such a happy event as this, would open an eaſy commerce between Great-Britain and America, in commodities which are now procured at the expence of long voyages and dangers. The bretheren of each country would then reap the advantages of their ſituation, and a Miniſter, whoſe councils have ſo well defended the property of the weſtern world in a glorious war, would feel the pleaſing ſenſation of having ſecured, and therefore promoted, the ARTS of PEACE.

FINIS.

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May 1964
Francis
Edwards

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